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A PHYSICAL METHOD OF SEPARATING BROMINE NUCLEAR ISOMERS

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The chemical method of separating bromine nuclear isomers (E. Segre, R. Halford, and G. Seaborg, Phys. Rev., 55, 321, 1939) is effective but quite complex. Experiments were undertaken to find a physical method of separating bromine nuclear isomers.

The experiments were carried out in the following manner: 50 cubic centimeters of ethyl bromide was bombarded by slow neutrons for several hours. Two hours after bombardment, the ethyl bromide was poured into a cylindrical glass vessel, 45 millimeters in diameter and 35 millimeters high, in which the ethyl was placed in an electric field. A silver disk 15 millimeters in diameter, attached to the end of a copper rod, served as the anode. One side of the disk and the entire copper rod were covered with celluloid; the other side, on which the radioactive atoms were to be deposited, was carefully polished. The cathode was made from a platinum sheet 10 millimeters wide in the form of a ring placed on the inside surface of the cylindrical glass vessel. A field of 100 volts per centimeter was applied to the electrode. During the time the current was flowing, approximately 20 minutes, the anode was rotated with a speed of 80 revolutions per minute. After separation of the radioactive material, the silver disk was placed in a special holder which permitted the experimenters to fix the position of the radioactive material accurately by an ionization chamber.

The intensity of electron radiation of radioactive bromine was measured by a cylindrical ionization chamber 100 millimeters in diameter and 150 millimeters high. A constant voltage of 1200 volts was applied to the internal perforated cylinder. A rod placed along the axis of the chamber was used as the second electrode.

An amber insulator with a large surface was used to insulate the internal electrode from the housing. The current generated in the ionization chamber was measured by a string electrometer connected to the internal electrode of the chamber. The sensitivity of the electrometer as a function of the intensity of the radioactive substance could be varied from several divisions to 200 divisions per volt. The silver

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disk with the radioactive bromine preparation was [illegible] movable stand. In order to filter out the slow electrons of [illegible] isomeric bromine, the bottom of the ionization chamber was made of [illegible] 20 microns thick.

By measuring the radiation intensity of the material [illegible] for radioactive bromine isotopes Br^{80} and Br^{82} were obtained [illegible] dividing the radioactive decay curves obtained into components corresponding to bromine half periods of 18 minutes, 4.4 hours, and 34 hours, it was possible to obtain the values of relative activities corresponding to each of these periods.

Extrapolation of these curves backwards to the moment when bombardment ends determines the initial activity corresponding to the decay of radioactive nuclei Br^{80*}, Br^{80}, and Br^{82}.

In the very first experiment, separating radioactive atoms by direct application of an electric field to the ethyl bromide bombarded by slow neutrons, a pure radioactive bromine substance was obtained in a film a fraction of a micron thick. The effective coefficient of separation for these experiments was found to be approximately 0.5 percent.

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